impact

Shaping the Future Through Creative Problem-Solving

College of Engineering and Applied Science

UNIVERSITY OF COLORADO
DENVER | ANSCHUTZ MEDICAL CAMPUS

2012

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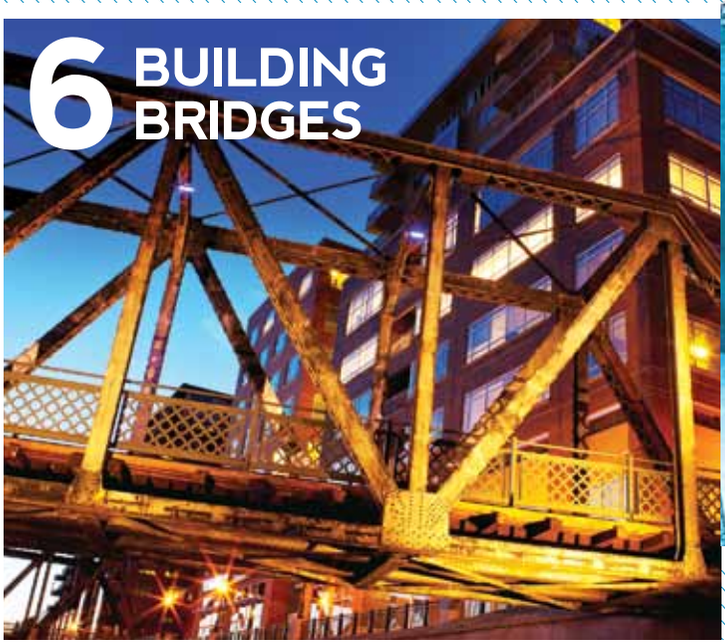

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ABOUT
Impact is published annually by the University of Colorado Denver College of Engineering and Applied Science for college alumni and friends. Send correspondence to Erica Lefeave, CU Denver College of Engineering and Applied Science, Campus Box 104, P.O. Box 173364, Denver, CO 80217-3364.

DEAN'S NOTE

Thirty years ago, sustainability was hardly a word in the engineering lexicon, even amid significant concerns about dwindling energy reserves, natural resources and the environment. Now it is one of the grand challenges facing our nation and the world.

Engineering solutions are becoming more constrained by considerations of energy, natural resources, water quality and quantity, climate change, sanitation, waste management, health issues and security. Engineers today must also consider economic, social and political challenges, making the problems we face even more complex. These challenges and constraints have made sustainable engineering solutions a priority.

Sustainability has long been a cornerstone in the mission of the University of Colorado Denver College of Engineering and Applied Science. Through educational, research and service activities, our students and faculty continuously find innovative and creative ways to solve everyday problems and improve the quality of life for people in the world around us.

We have students who developed a 500-mpg hydrogen-powered vehicle, faculty who are designing eco-friendly ionic liquids and an alumna who has tied her passion for one of Colorado's natural resources to her professional role at a national environmental consulting engineering firm. Other notable projects include research into porous and green concrete, converting biological wastes and sewage into electricity and life cycle analyses.

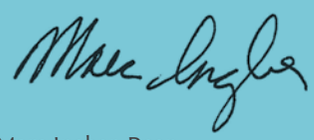
Our Center for Sustainable Infrastructure Systems is internationally recognized for its systems approach to carbon and water footprinting; water, waste and energy technologies; transportation; urban infrastructure; and green concrete. The center is outcome- and metrics-driven and has worked on sustainability issues for cities across Colorado, the nation and the world.

The college's sponsors and partners for these activities are impressive, including more than 15 Colorado municipalities, the governor's Energy Office, Denver's Urban Drainage and Flood Control District, the National Science Foundation, the Office of Naval Research, the Clinton Global Initiative, the AT&T Foundation, the Walmart Foundation and the Bill and Melinda Gates Foundation.

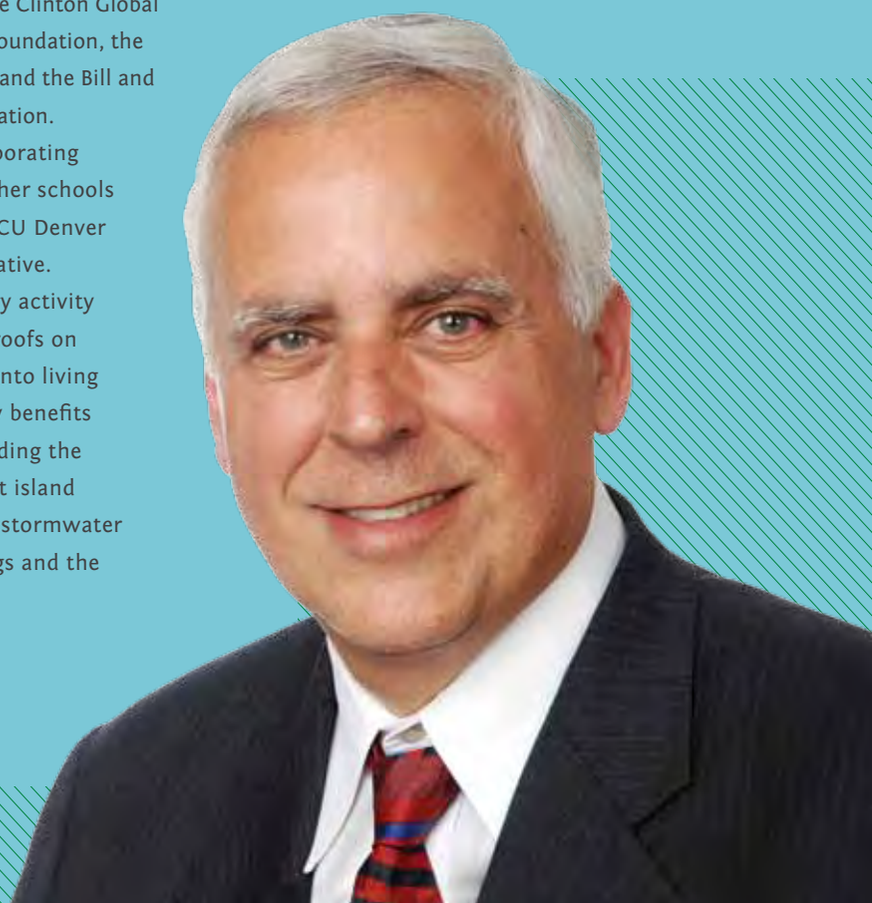
We are also collaborating with a number of other schools and colleges within CU Denver on a green-roof initiative. This multidisciplinary activity will retrofit several roofs on the Denver campus into living laboratories to study benefits of green roofs, including the reduction of the heat island effect, mitigation of stormwater runoff, energy savings and the symbiosis between the green roof and photovoltaic solar systems.

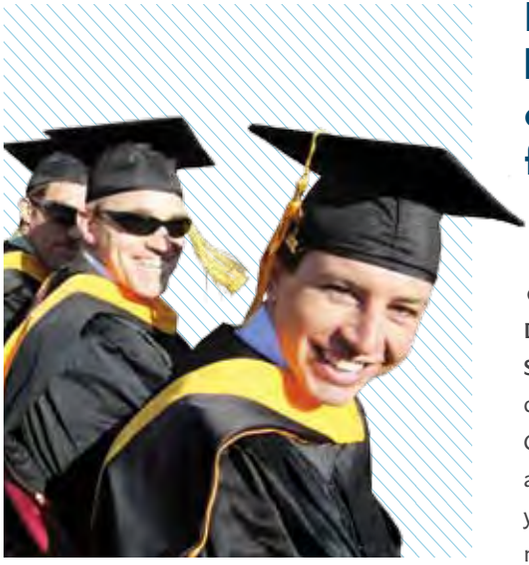
I hope you enjoy reading this issue of *Impact*, which highlights many of our accomplishments and activities in sustainability and gives you a glimpse into the creative problem solving that is taking place in our classrooms and community every day.

Kind regards,



Marc Ingber, Dean
College of Engineering and Applied Science
University of Colorado Denver





Inaugural bioengineering class graduates first students

The Department of Bioengineering graduated its first master of science students, **Maximo De Achaval**, **Derek Eilers** and **Stephen Humphries**, in the spring commencement at Anschutz Medical Campus. With more than 65 master's and doctoral candidates, this year's group of graduates marked a milestone for the department.

Collegewide PhD program admits first students

On October 6, 2011, the Colorado Commission on Higher Education approved the new collegewide Engineering and Applied Science PhD program. Eleven students have been admitted to the program for fall 2012. This is a one-of-a-kind program in the state.

2012 SEI

Student team wins second place at 2012 SEI Design Competition

A civil engineering senior design team and their project, Idaho Springs Maintenance Facility Design, won second place at the 2012 SEI Student Structural Design Competition. The team, comprised of **John Pettit**, **José Cordoba**, **Jeff Gee**, **Ramon Martinez** and **Jeff Felling**, along with faculty advisor **Peter Marxhausen**, presented their project at the 2012 Structures Congress in Chicago on March 29. This is the second year in a row that our civil engineering students have placed second in this national competition.

COMPETITIONS

Sustainability club wins at student competition

On March 5, U.S. Secretary of Energy Steven Chu announced the winners of the Better Buildings Case Competition; the CU Denver Sustainability Club was among them.

The Better Buildings Case Competition provides the next generation of engineers, entrepreneurs and policymakers with skills and experience to start careers in clean energy. Student teams competed to find the best solutions to the energy efficiency challenges presented in real-world case studies. The CU Denver team received the Most Innovative award for their case study for HEI Hotels and Resorts. Civil engineering PhD student **Tyler Huggins**, the leader of the CU Denver team, said the project was a true collaboration.

Other contest winners included Carnegie Mellon University, Columbia University, The George Washington University, Massachusetts Institute of Technology, University of California at Berkeley and University of Southern California.

College honors outstanding faculty, staff, alumni and students

At a celebration held on May 11, the college honored outstanding faculty, staff, alumni and students for their accomplishments and contributions to the college. Faculty, staff and alumni award recipients included **Zhiyong "Jason" Ren**, Outstanding Faculty in Research; **Dan Connors**, Outstanding Faculty in Teaching; **Bruce Janson**, Excellence in Service; **Kevin Rens**, Excellence in Faculty Mentoring; **Heidi Utt**, Outstanding Staff; and **Dan Roberts**, Distinguished Engineering Alumni.

Outstanding student award recipients were **Stephen Humphries** from bioengineering; **Alexandra Cheng** and **Andrea Solis** from civil engineering; **Moshe Redmon** and **Jared Candelaria** from electrical engineering; **Jordan Rivas** and **Lan Vu** from computer science and engineering; and **Lillian Chatham** and **Eric Snell** from mechanical engineering.

Student wins award at CU Denver symposium

Jennifer Chipman, graduate civil engineering student, and her project "The Value of International Collaborations in Understanding How Climate Change Affects Water Supplies from Snow Dominated Catchments" won one of four Outstanding Research and Creative Activity Awards at the 15th annual CU Denver Research and Creative Activities Symposium. Conducting research in Colorado and New Zealand, Chipman studied the relationships between climatological patterns and infrastructure designs for her project. More than 100 teams participated in the event.

CU Denver named an ACI Outstanding University for 2012

ONE OF **15**

CU Denver was one of 15 universities to be recognized by the American Concrete Institute (ACI) as an Outstanding University for 2011; this is the second consecutive year that the university has received this honor. More than 40 students from the College of Engineering and Applied Science are ACI members.

CU Denver has come to the forefront of concrete materials education and research in the state of Colorado, as a result of research in sustainable concrete materials, performance of concrete mixtures and pervious concrete, a program to certify students in concrete testing, and collaborations with industry partners throughout the state.

SPOTLIGHT

Ren receives campus excellence award

Civil Engineering Assistant Professor **Zhiyong "Jason" Ren** received the campus-level faculty award for Excellence in Research and Creative Activities. Ren was chosen by a selection committee comprised of previous award winners from throughout the university. The college congratulates Ren and thanks him for his dedication to the college and students.

Shape Ophthalmics receives Commercialization Grant

Shape Ophthalmics, a company cofounded by bioengineering chair **Robin Shandas**, is one of five CU-based companies to receive a State of Colorado Tech Commercialization Grant. The company develops shape memory polymer (SMP)-based devices for the delivery of medication to the surface of the eye for the treatment of eye diseases.

The grant, offered through Colorado's Bioscience Discovery Evaluation Grant Program, provides early-stage matching seed money to enable the development and commercial validation of technologies that are licensed from Colorado research institutions by Colorado-based start-up companies.

Since 2011, eight faculty have joined the college, with additional hires anticipated for 2013. Meet the new faces of the College of Engineering and Applied Science from 2011 and 2012.

RICHARD BENNINGER

Richard Benninger is an assistant professor in the Department of Bioengineering. Benninger joined the college in 2011. His research interests are to develop and apply quantitative fluorescence microscopy approaches and predictive mathematical modeling to understand how the islet of Langerhans—the area within the pancreas that contains hormone-producing cells—functions.

R. DANA CARPENTER

R. Dana Carpenter, assistant professor in the Department of Mechanical Engineering, joined the college in 2011. Carpenter leads the Smart Materials and Biomechanics Lab. He uses finite element modeling and mechanical testing to evaluate the effects of osteocyte lacunar density and morphology on bone mechanical properties, as well as medical imaging and mechanical testing for patient-specific optimization of spinal fusion devices. His research interests are in skeletal biomechanics and mechanobiology, biomechanical analysis of medical images and finite element analysis.

YAIL JIMMY KIM

Yail Jimmy Kim is an associate professor in the Department of Civil Engineering who specializes in structural engineering. He joined the college in 2012. Kim's research interests include sustainable infrastructure rehabilitation with advanced composite materials, intelligent structural system and smart composites, emerging structural materials including bio-building materials for structural application, bridge engineering, evaluation and sensing of constructed facilities, nonmetallic composite structures, computational modeling and interdisciplinary engineering.

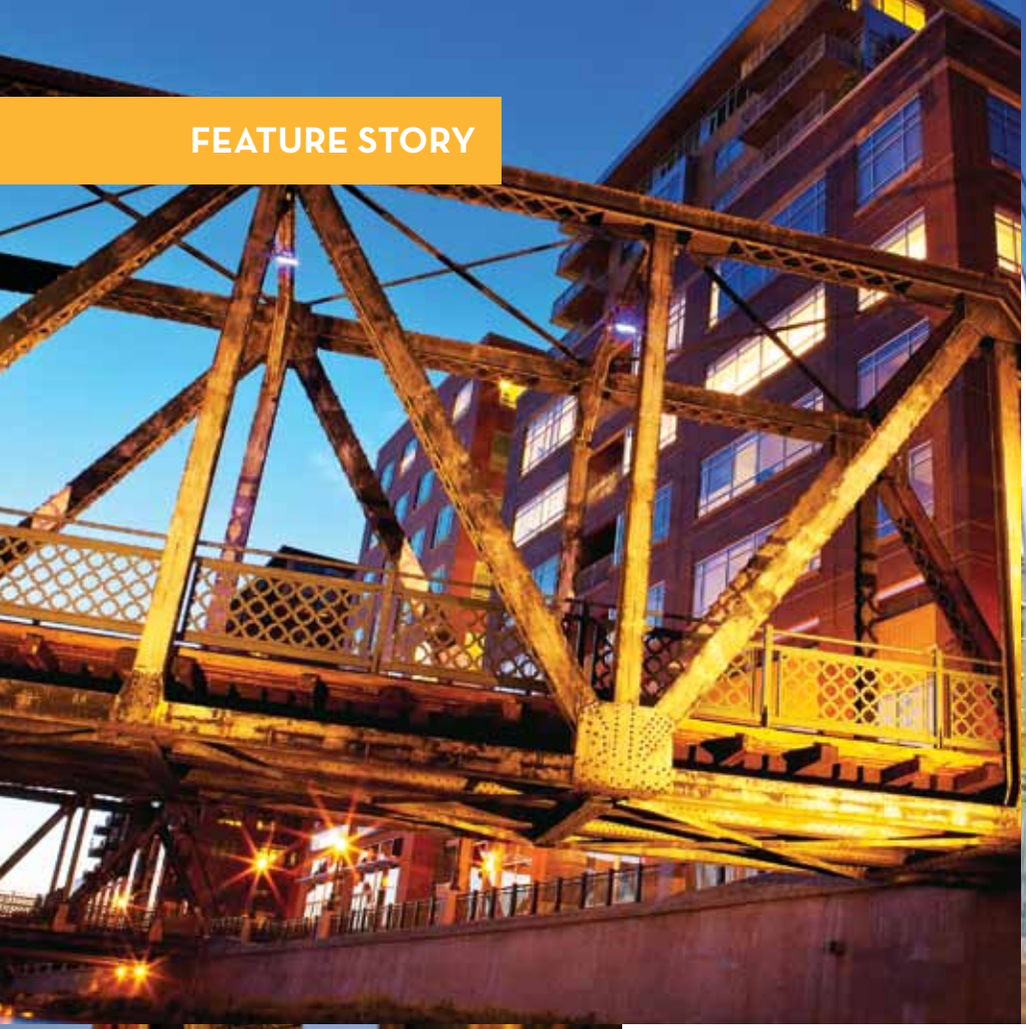
INDRANI PAL Indrani Pal is an assistant professor in the Department of Civil Engineering who specializes in environmental engineering. She joined the college in 2012. Pal's research interests include hydro-climatic predictive and diagnostic modeling, flood/drought risk assessment, climate variability and change, climate dynamics, climate diagnostic analysis and modeling, linear and nonlinear dimensionality reduction techniques, climate extremes and food security, and urban climate and hydrology.

DAEWON PARK Daewon Park, assistant professor in the Department of Bioengineering, joined the college in 2012. His research interests are in creating polymeric biomaterials with multi-functionalities. The highly translational technology, particularly biomaterials, greatly improves the bioengineering field and generates significant clinical impact. The main goal is the design, synthesis and characterization of new biomaterials for establishing a platform of biomaterials with high potential for applications to drug delivery, tissue engineering and regenerative medicine.

KANNAN PREMNATH Kannan Premnath, assistant professor in the Department of Mechanical Engineering, joined the college in 2012. His research interests include computational fluid dynamics and heat transfer, fluid dynamics, heat/mass transport phenomena, Lattice Boltzmann methods, advanced numerical methods, high-performance scientific computing and internal combustion engines.

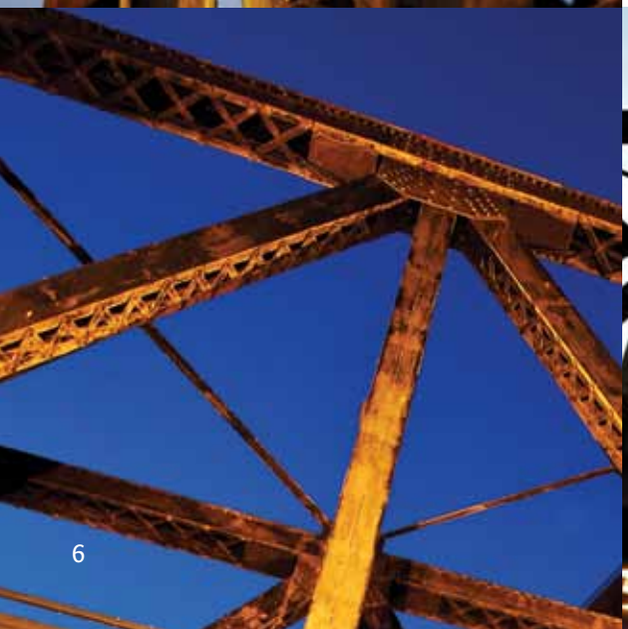
RICHARD WEIR Richard Weir, research associate professor in the Department of Bioengineering, joined the college in 2012. Weir's research interests include neural engineering, biomechatronics and rehabilitation. His current research covers all aspects of the mechatronic design and control of artificial hand/arm replacements ranging from mechatronic design and development, novel actuator technologies, development of neural control human-machine interfaces and clinical deployment of these systems.

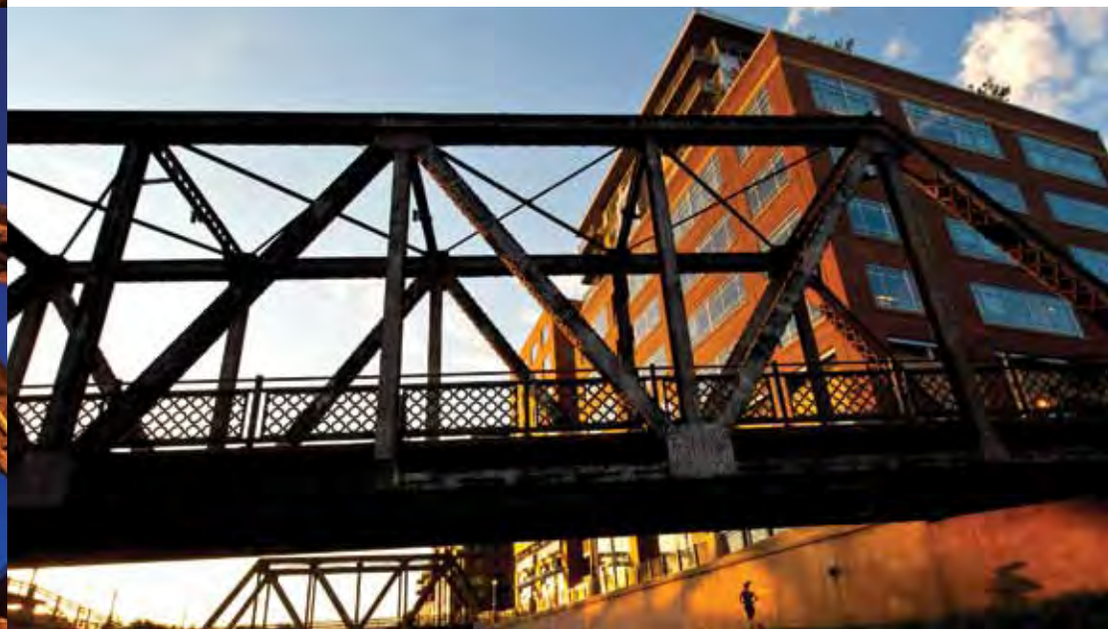
CHRIS YAKACKI Chris Yakacki, assistant professor in the Department of Mechanical Engineering, joined the college in 2012. His specialty is in biomechanics, and his research interests include shape-memory polymers, high-strength polymers, polymer structure-property relationships, active materials for biomedical devices, orthopedic soft-tissue fixation strength and mechanics of bone fusion.



BUILDING BRIDGES

to the community





If you have ever walked or driven over a bridge in Denver, you can count on one thing: Kevin Rens has been there.

Since 1997, Rens, faculty and chair of the civil engineering department in the College of Engineering and Applied Science, has inspected every one of Denver's 600 bridges, either annually or biannually, looking for any kind of change that could affect the safety of the public. "I'm kind of like the dentist who tells a patient, 'We are watching that crack in tooth number 15,'" says Rens. "We are observing any changes in these bridges that could create future problems."

$45 MILLION: NOT A SMALL DEAL

When Rens first met with Denver's chief structural engineer 15 years ago, the city relied on random complaints from citizens to determine which bridges should be repaired and in what order. He proposed a more systematic plan: enlist students under his supervision to do regularly scheduled bridge inspections.

That proposal resulted in a partnership between CU Denver and the City of Denver through which students can focus their master's or PhD theses on bridge repair projects and have the satisfaction of seeing their maintenance recommendations implemented. Today, the numbers testify to the program's success:

- More than 200 students have participated.
- Students have been paid more than $4 million for their work.
- More than $45 million has been invested in bridge repairs.

"That [amount of money] is not a small deal," says Rens. "But it's a win-win. The students get experience and their degrees. The city gets sound engineering at an economical rate."

Jim Barwick, Denver's chief infrastructure engineer, echoes Rens when he talks about "good quality work" done by "motivated, eager" students from CU Denver. "They scratch our back and we scratch theirs," says Barwick. "This partnership has been as enriching for us as it has been for the students."

INSPECTIONS: A HEALTH SCORE

Think of Rens as a bridge doctor doing annual physicals on every bridge, looking for ailments small and large, anything from minor loose nuts and bolts to major structural damage.

In fact, one of Rens' doctoral students, Xin Jiang, developed the "Denver Bridge Health Index," a single number indicating a bridge's health, with 0 percent denoting a bridge in the worst possible condition and 100 percent marking one in the best condition.

Another student, Elisabeth Cole, is using work on the Evans Avenue bridge over Santa Fe Drive as part of her master's thesis. She's comparing the results of a visual inspection of the Evans bridge with a second inspection done using sensors attached to the bridge.

"I really enjoy structures," she says. "We all need them, we all use them, and I like to learn how a structure will behave during its life." Cole estimates that the engineering team's second inspection will save Denver $1 million in repairs. By the time she finishes her thesis, she will have made great connections within the city. "If you do good work, there are jobs you can get right out of school," she says.

SURROUNDED BY POLICE

Rens has had his share of strange encounters over the years as he's made the acquaintance of every bridge in Denver, but the most bizarre experience happened in late September 2001 when the country was on heightened terror alert in the wake of 9/11. He and a team of students were working in the railroad yard under the 6th Avenue viaduct, attaching sensors to the bridge to inspect it.

"We were listening to the radio," remembers Rens, "and we heard that the 6th Avenue viaduct had been shut down and the area evacuated because of suspicious activity. And I thought to myself, 'That's weird. I wonder why we weren't evacuated.' And within minutes we were surrounded by police cars."

It took some explaining, but Rens finally convinced the police that his sensors were no threat and, in fact, he was working to ensure the safety of the traveling public.

EYE CANDY

A few of the bridges Rens inspects have passed their centennial. Built to carry trains, they now carry pedestrian traffic. But they still need annual inspections and maintenance to stay safe. Rens knows that some observers might think it more cost-effective to simply replace an old bridge with a new one.

"There are some valid points to that school of thought," he acknowledges. "But the historic nature of these bridges makes them an art form. Keeping them is historic preservation and an asset to Denver's eye candy."

After keeping its "eye candy" safe for the past 15 years, Rens and his students look forward to a long partnership with the city, and to building more bridges between the university and the community.

Designing sustainable urban infrastructure in Delhi: PhD Students recieve Fulbright-Nehru Awards

The J. William Fulbright Foreign Scholarship Board has selected **Elliot Cohen** and **Josh Sperling** of the Center for Sustainable Infrastructure Systems at University of Colorado Denver to receive Fulbright-Nehru awards to India in 2012-13.

ELLIOT COHEN

The Energy and Resources Institute (TERI) University in Delhi, India, will host Sperling and Cohen. There, they will be conducting their PhD research, giving guest lectures and collaborating on fieldwork related to designing effective and sustainable urban infrastructure systems of the future.

Cohen's research, titled "Quantifying Risk to Critical Water-Energy Infrastructure in Delhi, India," aims to study the water-energy nexus in Delhi. In his Fulbright proposal, Cohen writes: "Water and energy infrastructure are the foundation of modern cities. They are also inextricably and reciprocally linked. Water shortages can shut down major power plants due to lack of cooling water, and energy shortages can halt the operation of potable water and wastewater treatment plants, posing direct risk to public health."

Sperling's research, titled "Health Outcomes as a Motivator for Low-Carbon Cities: Implications for Infrastructure," focuses on the links between public health, infrastructures and climate change in cities. His research explores the extent to which upgraded infrastructures (e.g., water, energy, transport) and infrastructure-related environmental factors (e.g., air and water quality) shape current urban health outcomes. In collaboration with in-country hosts TERI University and the Urban Health Resource Centre, Sperling aims to develop a more robust evidence base for local and inclusive decision making on urban infrastructure interventions that can have significant impacts on improved health and low-carbon development.

Cohen and Sperling are two of about 1,500 U.S. students who will travel abroad to more than 140 countries in the 2012-13 academic year through the Fulbright Scholar Program. Since 1946, the program has offered more than 307,000 grants for individuals to study, teach and conduct research in foreign countries because they have demonstrated extraordinary leadership potential in their fields.

JOSH SPERLING

Beyond Sperling and Cohen's similar research interests and shared honor of receiving Fulbright awards, they also each spent several years during their undergraduate careers as active leaders in their respective university chapters of Engineers Without Borders, a nonprofit humanitarian organization established to partner with developing communities worldwide on sustainable infrastructure projects that can improve quality of life. In 2009, the college's PhD program in environmental engineering and the university's NSF-funded interdisciplinary IGERT program on sustainable urban infrastructure brought them together at CU Denver, enabling them both to pursue advanced study in arenas for which they are passionate: finding ways to make communities, cities and the world better places for all inhabitants.

Center for Sustainable Infrastructure Systems

The CU Denver Center for Sustainable Infrastructure Systems includes the interdisciplinary IGERT grant (spanning engineering, planning, policy, health and behavioral sciences) and is presently a joint center created in partnership between the College of Engineering and Applied Science and the School of Public Affairs. Learn more about the center at engineering.ucdenver.edu/csis.

ALUMNI PROFILE

PERSISTENCE+FOCUS

guide Alumna Mary Gearhart in her professional endeavors

Mary Gearhart is a Colorado native who loves to explore the state's nooks and crannies. She is exceptionally aware of the beauty and natural resources it has to offer and is passionate about finding ways to effectively use and protect them. Since graduating from CU Denver in 1979 with a civil engineering degree, she's focused her professional endeavors on one of the state's most precious resources: water.

"I always knew I wanted to work in water," she says, "particularly in the West." As a result, all of her career choices have been made with that in mind.

Gearhart is a senior vice president at Brown and Caldwell, a national consulting engineering firm that specializes in water-related engineering projects. She leads the company's Design Management Office, which manages the design process, develops state-of-the-art tools and keeps the workforce informed of the latest technologies. She also oversees the Project Management Office, which controls the execution of the company's projects.

"I have always enjoyed project management, and the design management duties are a nice addition to that," she says. "I like these two assignments because I can develop our staff, mentor and coach them or find them new and interesting opportunities. It's wonderful to be able to share things I have learned about engineering and business with the generations behind me." Gearhart works with about 30 percent of Brown and Caldwell staff nationwide.

Trying new, different and more difficult things has helped her reach this point in her career; Gearhart believes her CU Denver engineering education contributed to her strong work ethic and professional success. She remembers many professors who offered guidance and tools for students to learn and succeed. They pushed students to completely think through engineering problems and to try all possible solutions on their own before asking for help, a skill that's stayed with her.

> "I believe that everyone should get the chance to make the most of his or her life's potential."

"I still work very hard to this day to solve problems on my own before I ask for help," says Gearhart. "It gives me confidence, helps me to see when the right solutions present themselves and shows others that I am persistent. Those are all valuable attributes in day-to-day engineering."

Dean Emeritus Paul Bartlett made a lasting impression on Gearhart with his leadership skills and no-nonsense approach to education. "He was fair, honest and tough," she says. "Everything we did had a purpose, a time frame and a reason ... The program showed us how to be independent thinkers, researchers, students, workers and friends all rolled into one grand adventure."

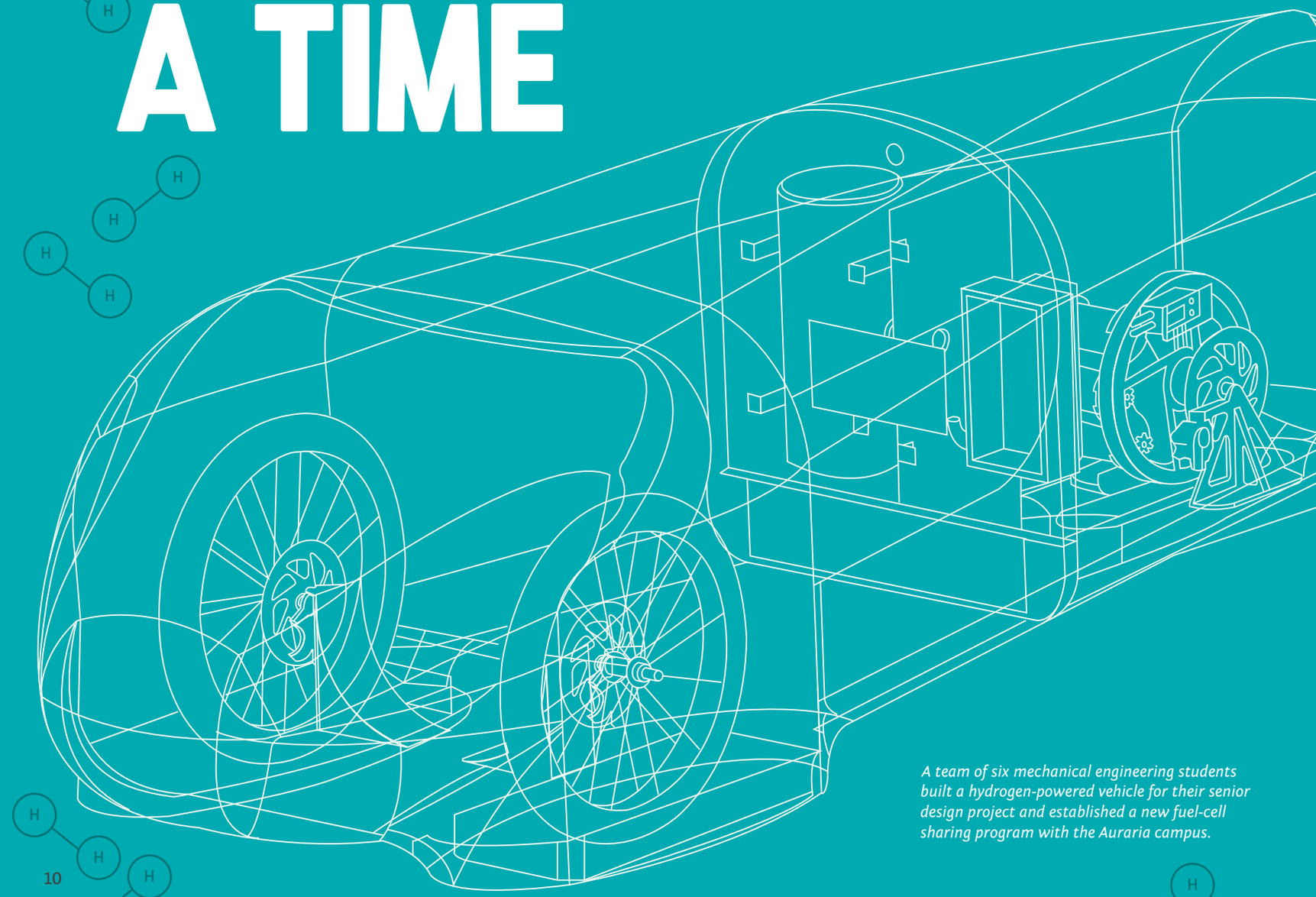
She impressed Bartlett as well. Two years after graduating, he invited Gearhart to join the college's leadership council to provide insight from a recent graduate's point of view. As an active member on the council 30 years later, she strives to help the college maintain its foundation of excellence for current and future students.

"Education is transformational, and I believe that everyone should get the chance to make the most of his or her life's potential," she says. "As a graduate of CU Denver, I can't think of any place that better suited my circumstances. Today, we continue to build our program ... the students just have to look for us and work hard to get the opportunities to succeed."

Civil engineering alumna Mary Gearhart has been involved with the college since graduating in 1979.

FEATURE STORY

CHANGING THE WORLD ONE PROJECT AT A TIME



A team of six mechanical engineering students built a hydrogen-powered vehicle for their senior design project and established a new fuel-cell sharing program with the Auraria campus.

When six mechanical engineering students began their senior design capstone project last fall, they aspired to design and build an alternative-energy-powered vehicle to compete in the Shell Eco-marathon Americas—a contest where top engineering students from the Western Hemisphere compete for ultra fuel-efficiency—and to create a design that promotes the use of alternative energies and improvements in transportation technology. They didn't know they'd initiate a partnership that would benefit the Auraria campus community for years to come.

THE PROJECT

"When we started, we didn't know what kind of energy we wanted to use for the car," says team member Keith Nguyen. "We decided to use hydrogen. We wanted to try and do something that will help society in the long run."

The students, **Michael Dennison, Mark Maceda, Loi Ngo, Keith Nguyen, Tony Nguyen** and **Marcel Sorel**—Team Mile Highdrogen—delved into research. Information about hydrogen-powered vehicles was hard to find, and the team knew they had chosen a difficult project. However, once they made the decision to use hydrogen, there was no going back.

Construction of the vehicle began in January; nearly 80 percent of the materials needed for the car were manufactured by the team.

"The learning curve was a big factor," says Nguyen. "No one had experience related to the process. When it came to machining parts, we messed up a lot of things ... we probably could have made two cars with all the parts we made."

After the team spent numerous 12-hour days in the shop and invested a lot of dedication and hard work into the project, the vehicle was finished and ready to compete. The final product was a single passenger, three-wheeled, hydrogen-powered electric motor prototype capable of the equivalent of 500 mpg while producing close to zero negative emissions. The car weighs about 160 pounds and can reach 35 mph.

SHELL ECO-MARATHON AMERICAS

Competing in the Shell Eco-marathon Americas (SEMA) in Houston, although an initial objective of the project, added some challenges. Because it was their senior design project, the team was required to submit quarterly reports and project-related assignments in addition to constructing and testing the car. With the competition scheduled for March, the team had to push themselves to get the vehicle in working order almost a month and a half before the project was due.

"We worked on the car up to the time we left," says Nguyen, "and we were still working on it when we got there." Unfortunately, things at SEMA didn't go as planned. The team passed technical and safety inspections with no issues and had perfect practice runs. But then the vehicle developed some problems that were out of the team's control, and in the end they were unable to compete. Despite the setbacks, the students reveled in the opportunity to present their design and to represent the university on an international scale.

"With all of the challenges, I think we ended up with a superior project," Nguyen says. "I think it helped us all become better students and better prepared for our professional careers."

MAKING ENDS MEET WITH A BENEFICIAL PARTNERSHIP

One of the biggest challenges the team faced was funding. Each student is given $300 from the mechanical engineering department to fund his or her project. When Team Mile Highdrogen completed their project cost analysis in October, they estimated the project at $15,000; the cost of the fuel cell alone was $8,000. The team immediately began soliciting for sponsorships.

Cont'd on page 12

Team Mile Highdrogen (left to right): Tony Nguyen, Keith Nguyen, Michael Dennison, Marcel Sorel, Mark Maceda and Loi Ngo (front).

The hydrogen-powered vehicle took three months to build; 80 percent of the materials were manufactured by the team.

Feature cont'd

"Basically we'd talk to anyone who'd listen," says Nguyen. "We hit a lot of dead ends." The team eventually secured a few private donations, and a local company donated the composite materials to construct the body of the car. A mechanical engineering teaching assistant, Nili Krausz, recommended the team look into the Auraria Sustainable Campus Program (SCP) for funding.

> "It's cool to think that maybe as engineers, we can somehow do these things down the line ... and just make the world a better place."

The SCP is a student-driven subcommittee of the Student Advisory Committee to the Auraria Board (SACAB) with the mission of reducing the campus's ecological impact and dependence on fossil fuels. The program is supported by student-approved fees with the intent to expand the program's reach, to fund projects on campus with a sustainable focus, and to support education and outreach in regard to these programs.

"As part of the Sustainable Campus Program, members of the Auraria community are invited to submit proposals for funding in one of the sustainable project categories," says Jon Bortles, sustainability officer for the Auraria Higher Education Center. "The Mile Highdrogen team did just that and submitted a funding request out of the 'education and outreach' program category."

It took about two months for the proposal to get approved, and the team received notification in early March that SCP and SACAB had approved funding for the project in the amount of $14,000.

"Both the Sustainable Campus Program and SACAB consider the sustainable campus fund as a resource for class projects and student engagement," says Bortles. "Being able to promote 'clean' technology, environmental stewardship and student innovation, this project certainly spoke to the mission of the program."

The team's proposal included a long-term plan to create an Auraria fuel cell program that allows students from all three institutions to use the fuel cell in their own research projects. "This type of shared use on the Auraria campus is something the Sustainable Campus Program and SACAB feel very strongly about when considering projects," Bortles says.

Mechanical engineering associate professor and senior design advisor Ron Rorrer commends the team for working with SCP. "It is an excellent connection to campus," he says. This is the first senior design team to receive support from SCP.

The fuel cell and car will likely stay intact until another group of students or faculty use the fuel cell for a new project. "In the fall semester we plan to ramp up promotion and outreach to solicit new applications to use the fuel cell," says Bortles. "Since CU Denver had it first, it is now up to the Community College of Denver and/or Metro State to come up with a new project idea."

MAKING A LASTING IMPACT

Throughout the entire project, the underlying goal—to create a design that promotes the use of alternative energies and improvements in transportation technology—never changed. Now that the project is finished, Team Mile Highdrogen is discussing the probability of hydrogen-fueled vehicles becoming more common.

"If you could drive up to a gas station that was hydrogen or electric, that would be the most beneficial way for these alternatively powered vehicles to get used more widely," says Nguyen. "Electric cars have the same problem. Individually they're beneficial, but looking at the big picture it's hard to get positive results because the infrastructure doesn't exist." That's not to say the team isn't optimistic, and they hope that future students find new and innovative ways to use the fuel cell.

"It's cool to think that maybe as engineers, we can somehow do these things down the line," says Nguyen, "and just make the world a better place."

FACULTY PROFILE

Civil engineering faculty receives

NSF CAREER AWARD

Arunprakash Karunanithi, assistant professor in the Department of Civil Engineering, has received a National Science Foundation Faculty Early Career Development (CAREER) award in the amount of $400,000 to pursue research and educational activities in the area of green engineering. CAREER awards are the National Science Foundation's most prestigious awards supporting junior faculty who exemplify the role of teacher-scholars through outstanding research, excellent teaching and the integration of education and research.

"It is truly a great honor to receive the CAREER award and to be considered among an elite group of young scientists," says Karunanithi. His project focuses on discovering new classes of chemicals called ionic liquids, which have unique properties and are also environmentally benign. The research stems from the desire to develop new products that can replace environmentally harmful chemicals as well as address climate-change issues through technological breakthroughs.

"Future replacement of organic compounds with these chemicals will result in significant health and environmental benefits to the society," he says.

A benefit of ionic liquids is that nature allows millions of variations to their structures, most of which can be synthesized fairly easily. This provides the opportunity to carefully tune their structures to impart specific functionalities that are of interest.

"The challenge is finding the right kind of ionic liquid for the right application. It is like looking for a needle in a haystack," says Karunanithi. "Fortunately, by using theory and computer simulation models we can search through millions of previously unexplored possibilities and find optimal ionic liquid structures for given applications."

> "It is truly a great honor to receive the CAREER award and to be considered among an elite group of young scientists."

Another relevant issue is that while ionic liquids are inherently environmentally benign, the processes involved to produce them can be energy intensive and may result in significant greenhouse gas emissions. This research allows the integration of environmental life cycle assessment methods with computer-aided ionic liquid design models to make sure the designed ionic liquids have a minimal carbon footprint.

"The exciting part about this research is the unlimited potential that ionic liquids offer," he says. "They are showing great promise in a variety of applications, and researchers worldwide—including our group at CU Denver—are at the forefront of discovering these new, greener chemicals for important and pressing applications."

Through the CAREER award, Karunanithi also intends to pursue educational activities that promote green engineering, including innovative mobile laboratory tours planned for K–12 schools to inspire young people to learn about green chemistry and spark their interest in science, technology, engineering and mathematics (STEM) education. "STEM education for K–12 students has become a priority worldwide, and this project will be a great way to get them excited and want to learn more," he says.

Assistant Professor Arun Karunanithi received an NSF CAREER award for research in green engineering.

Focus on the heart: Bioengineering PhD student Arati Gurung

Arati Gurung is fascinated with images and the stories they tell, she is inspired by the medical field and finding ways for people to live healthier lives, and she enjoys developing ways to solve problems. As a PhD student in bioengineering, she is able to tie all of these things together.

"Bioengineering is what I'm passionate about," says Gurung. "I really appreciate that you can use technology and engineering solutions to dissect clinical problems and find solutions to them—whether simple or complex."

It took a little time, a lot of studying and some heartfelt soul-searching to get to this point. Gurung holds a bachelor's degree in computer science and engineering from CU Denver, a master's degree in clinical nursing from the University of Maryland, Baltimore and a master's degree in biomedical engineering from Johns Hopkins University. "I needed the biomedical experience before I started my PhD to make sure I was doing the right thing," she says. "I learned about the new CU Denver bioengineering program, and it was the perfect opportunity to return to Colorado."

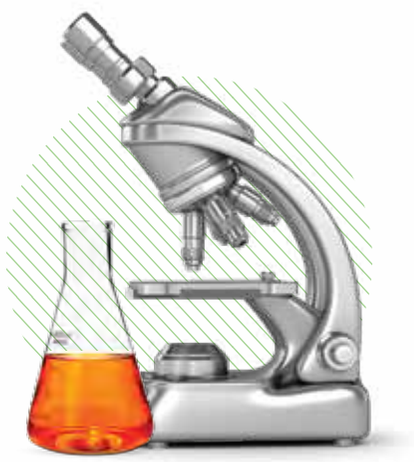
Gurung wanted her bioengineering studies to involve imaging. After her initial meeting with bioengineering department chair Robin Shandas, she chose to focus on the heart. Her research is on the early detection and prevention of cardiovascular diseases in diabetics through the development of minimally or noninvasive imaging techniques. Using multiple research methods, including ultrasound and Echo Particle Image Velocimetry—an algorithm to calculate blood-flow velocities by using a sequence of ultrasound images of an artery developed in Shandas' Flow Lab—she is developing markers to identify irregular or damaged cells that line blood vessels and precede plaques that build up and cause cardiovascular disorders in diabetic patients. The intention is to create a universal health index for the early detection of cardiovascular disease.

"What I really appreciate about bioengineering is that we can use technology to mitigate some of the disparities that exist in health care," says Gurung. She says that having two faculty from the CU School of Medicine on her dissertation committee helps put the research problems she faces into perspective. "The [School of Medicine] faculty help us approach problems from the clinical standpoint, not just engineers coming up with novel, cool engineering solutions. It's a nice balance of advisors."

Gurung intends to continue her research after she finishes her degree in 2014. "The ultimate goal is to help promote healthier lives free of cardiovascular diseases," she says.

Outside of her studies, Gurung works hard to find a balance between school and her personal life. She enjoys making short films, watching movies, listening to music, learning new languages (currently German), sailing and playing soccer, and she has a love for portrait photography.

"It amazes me how you can capture a picture of somebody and it can tell you a story of that person; it's fascinating," says Gurung. "Something as simple as a picture or film—or even in my research, an ultrasound image—you can look deeper into something that you don't have immediate access to."



STUDENT PROFILE

Electrical engineering student Darick LaSelle finds a new perspective

Four years ago, Darick LaSelle was working two jobs—one as a bartender and one as a customer service representative. When his wife, Lynda, found out she was pregnant with their first child, he knew something needed to change.

When LaSelle began his education in electrical engineering, he did so for entirely logical reasons: a stable job, a steady income and time with his family. However, it has since developed into much more, affecting his life in ways he never imagined: academically, personally and professionally.

While it hasn't been easy, he's accomplished a lot with the support of his family. Taking anywhere from 6 to 13 credit hours per semester while working full time and being a father and husband, he has maintained a 3.82 GPA and will graduate in May 2013. He is the CU Denver student chapter president of the engineering honor society, Tau Beta Pi, which, under LaSelle's leadership, boasts the strongest single initiation this spring for the Colorado Epsilon with 30 new members. He is also an active member of the Golden Key honor society.

Perhaps the most rewarding thing to come from his educational experiences, however, is the Matty Project through which LaSelle teaches energy and engineering to children with autism. In August 2010, LaSelle's son, Matt, was diagnosed with autism. At two and a half years old, he was nonverbal; speech therapists gave Matt a 50/50 chance of speaking. This fall, a mere two years later, Matt began attending a standard preschool.

"The help and support of the autism community, the professionals, the doctors and the other parents has really been miraculous," says LaSelle. "The Matty Project is a way for me to give back."

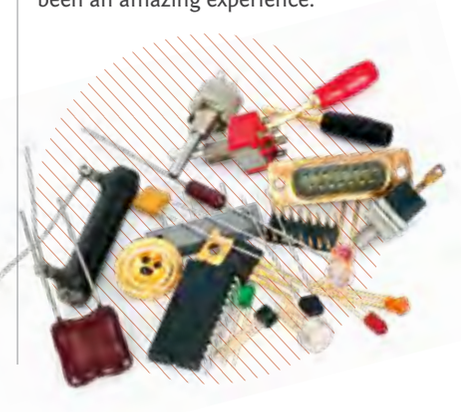
The first session of the project ran for six weeks and focused on energy. Five children with varying degrees of autism participated. "We started by performing very basic experiments like building a switch out of two metal plates." By the final session, the children built radios.

"It is indescribable how you feel when you suddenly see the kids understand something they never thought possible and realize how much more they can learn," says LaSelle. "With all the things we strive for in life, this one really made me feel like I was doing something important." He hopes to begin the second session this fall.

LaSelle has also found a field and a profession that he truly enjoys. "Working on designs and builds for projects and with teams of engineers is fun for me," he says. "Having an engineering degree will enable me to do that better and in a bigger capacity."

LaSelle works as a programmable logic controller at Custom Instrumentation Services Corporation, based in Centennial, Colorado. He is also in the process of applying for graduate school and hopes to continue his electrical engineering education to the doctoral level.

The process, as a whole, has been a growing experience. "From a technical standpoint, I have better critical thinking skills; professionally, I have a more mature outlook—I can understand technical requirements and have a more systems-oriented view," he says. "Personally, I now feel like I can achieve just about anything I set my mind to. Actually seeing the work I have put into this endeavor produce meaningful results in all aspects of my life has been an amazing experience."



STUDENT PROFILE

A love of the sciences pushes PhD student Lan Vu to succeed

Five years ago, Lan Vu moved to Colorado from Vietnam to pursue a master's degree in computer science at the University of Colorado Denver. Inspired by her research and the faculty, Vu is now pursuing a PhD in computer science and information systems.

"My current research was inspired by my undergraduate research in handwriting character recognition," says Vu. "I developed software to learn optical character patterns, and the training task frustrated me because it was very time consuming. When taking the Parallel and Distributed Systems course at CU Denver, I was extremely excited to find a solution for this issue." This finding motivated her to continue her studies and investigate parallel computing at a deeper and broader level.

Vu is researching new parallel methods for data-mining tasks which are applied in large-scale data analysis applications. The goal is to efficiently deploy these applications on large computer systems such as clusters and supercomputers.

Since beginning her studies, Vu has been an asset to the Department of Computer Science and Engineering. She manages the Parallel and Distributed Systems (PDS) Lab and is charged with ensuring that the machines support all of the lab's teaching and research activities. Vu is constantly developing new expertise to meet student and faculty needs.

"I built the PDS Lab website with basic technical documents, and I designed a set of lab assignment instructions to give graduate students hands-on experience working on multicore computer systems," says Vu. "I love assisting graduate students in their studies related to lab activities like research ideas, debugging parallel programs, consulting, instructing and installing software."

Her advisor, computer science and engineering chair Gita Alaghband, says Vu is creative, self-motivated and thoughtful in her research, and she always takes the initiative to get things done to the best of her abilities. These qualities contributed to Vu receiving the 2012 Outstanding Graduate Student in Computer Science and Engineering award.

"Receiving this award was a great honor because there are a lot of excellent students in our department," she says. "I immediately showed it to my parents in Vietnam to let them know that I am doing well in the United States. It also motivates me to work harder."

One day, her hard work will pay off. "My greatest desire is to become a professor who researches new advanced computing methods and can disseminate the knowledge of these methods to community and society, especially students and colleagues," says Vu. She credits CU Denver for enabling her to pursue her dream or a career in research. "I am very thankful for the support I have received from CU Denver. It encourages me to work harder for meaningful research results and to be active with all of my academic activities."

UPCOMING EVENTS

COMPETE

Fall Senior Design Competition

DECEMBER 14, 2012, 9:00 A.M. | NORTH CLASSROOM ATRIUM

Each semester the college holds a competition where industry judges select top senior design projects and teams for recognition. Come see our students' finest work as they compete for cash prizes. Visit engineering.ucdenver.edu/seniordesign beginning in December for information about the showcased projects.

MINGLE

Alumni Appreciation Reception

OCTOBER 2012 | DOWNTOWN DENVER

This fall, the college is hosting a special engineering alumni reception in downtown Denver. Watch your mailbox for an invitation.

COMPETE

Spring Senior Design Competition

MAY 17, 2013, 8:30 A.M. | NORTH CLASSROOM ATRIUM

You're invited to come see our students' finest work as they compete for cash prizes at the spring senior design competition. Visit engineering.ucdenver.edu/seniordesign beginning in late April for information about the showcased projects.

CELEBRATE

College of Engineering and Applied Science Celebration 2013

MAY 17, 2013, 11:30 A.M. | LOCATION TBD

Join faculty, staff, students and alumni for a casual lunch, conversation and an award ceremony as the college hosts its second annual year-end celebration. Honorees will include outstanding faculty, staff, students and alumni. Stay tuned to engineering.ucdenver.edu/celebration for details this spring.

What's your story?

We've shared some of our stories, and now we want to hear from you. Tell us about the impact you're making by sending an update to Erica Lefeave at erica.lefeave@ucdenver.edu or at CU Denver College of Engineering and Applied Science, Campus Box 104, P.O. Box 173364, Denver, CO 80217-3364.

Get involved

One of our strengths is our ties to the community and our alumni, and we are always looking for ways to build stronger connections. If you want to get involved with the college—as a mentor, volunteer or through internships—contact Erica Lefeave in the Dean's Office at erica.lefeave@ucdenver.edu or 303-352-3675.

Make a gift

If you'd like to make a gift to the college or to a specific department, contact Noelle DeLage with the CU Foundation: noelle.delage@cufund.org or 303-315-2026.

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